Better Land Use Planning For Coastal Virginia

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November 2004

Table of Contents

Tables

Case Studies

This project was funded by the Virginia Coastal Resources Management Program at the Department of Environmental Quality through Grant #NA17OZ1142 of the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management, under the Coastal Zone Management Act of 1972,as amended.

The views expressed herein are those of the authors and do not necessarily reflect the views of NOAA or any of its subagencies or DEQ.

Executive Summary

The Future of Coastal Virginia?

Over the next twenty years, suburban development will convert hundreds of thousands of acres of Virginia's coast line from forest, wetland, and farm fields to urban and suburban land uses. This land conversion will destroy and fracture large amounts of animal habitat and drastically alter the natural hydrology of the coastal environments. Every day activities of coastal residents will result in devastating amounts of nonpoint source pollution that will poison coastal waters destroying oysters, submerged aquatic vegetation, wetlands, and fish stocks. Lawns, driveway, rooftops and swimming pools will replace essential animal habitat along the shoreline, eliminating habitat that occupies the critical land-water interface. The same beauty and fecundity that draws people to Virginia's coasts will be bulldozed and smothered to house a burgeoning population that will add one million new residents by 2020.

The Chesapeake Bay Preservation Act

For more than a decade, Virginia's Chesapeake Bay Preservation Act (the Bay Act) has represented a cooperative program between state and local governments aimed at reducing nonpoint source pollution. The program is designed to improve water quality in the Chesapeake Bay and its tributaries by promoting the application of sound land use planning and management practices on environmentally sensitive lands – referred to as Resource Protection Areas (RPA) and Resource Management Areas (RMA). By implementing the state law through local land use ordinances, the Act allows flexibility to meet local needs, both in terms of existing water quality conditions and unique land characteristics and in terms of the existing regulatory system, yet provides uniform standards for use throughout Tidewater to ensure a basic level of consistency among the various local programs. Despite the success of the Bay Act, the extreme pressure of coastal development demands new and innovative land use planning approaches for better coastal planning.

New Opportunities

Although the expected population growth along Virginia's coasts will not be avoided, the impact on the coastal environment may be mitigated through thoughtful coastal planning. Coastal planning combines broad landscape or regional scale planning with site planning to better protect sensitive coastal environments. Regional planning steers necessary development away from sensitive coastal lands and waters. In exchange, development is encouraged in previously degraded coastal areas that encourage the establishment and growth of high-density, mixed use communities. Directing future growth to previously impacted coastal areas helps reduce development pressure on sensitive coastal areas and takes advantage of economies of scale that allow for more efficient land development and infrastructure use that helps protect coastal environments.

Better site design ensures that when development occurs it is integrated into the coastal environment in a manner that protects the unique hydrologic, geologic, and biologic elements that make the coastal environment so productive and attractive. Careful mapping of shoreland features allows local planners and developers to develop effective site designs that protect natural features and manage stormwater runoff well. Careful placement of septic systems and landowner education regarding lawn and pet care can help minimize nonpoint source pollution that can harm coastal water quality. Better site design can also help planners and developers address shoreline armoring and access issues in a comprehensive manner, minimizing the potential for destructive impacts to the shoreline from individual landowners independently armoring their properties and providing private water access.

Many Virginia localities are already making substantial progress in conducting more effective coastal planning. Cities in Hampton Roads are creating or redeveloping high-density, mixed-use downtowns. Communities throughout the coastal region are redeveloping brownfields and greyfields to allow impacted lands to maximize their development potential while also improving water quality. Many of these accomplishments are celebrated in this document.

1.0 – Introduction: Land Development and Virginia's Coasts

Virginia's coastal zone, roughly defined as the portion of Virginia east of Interstate 95, is already home to the majority of the Commonwealth's population, largely in the highly developed areas referred to as the "urban crescent." Between 1990 and 2000 the population of Virginia's coastal zone increased by more than half a million people, accounting for more than 60% of the population growth in the entire state (Virginia Coastal Program, 2001). If the population continues to increase as it did between 1990 and 2000, Virginia's coastal zone will add an additional one million residents by 2020.

Virginia's coastal zone covers 8,950 square miles (5,727,977 acres). Almost 2,400 square miles (1,535,994 acres) of this area is open water. The coastal zone is estimated to have over 10,000 miles of tidal shoreline (Virginia Coastal Program, 2001).

Providing places to live, work, play, and shop, and all the infrastructure required by these land uses, requires the permanent conversion of forests, wetlands, farms and meadows to urban land uses. More specifically, a tremendous amount of the the economic value, habitat potential and aesthetic quality of Virginia's coasts are in many ways dependent upon a handful of critical coastal features. Although increasingly threatened by poorly planned coastal development, submerged aquatic vegetation, oysters, riparian forest buffers, tidal wetlands, and sand dunes protect water quality, provide food and habitat for numerous coastal species and help buffer coastal areas from damaging wind and wave energy (see Table 1.0 for more information).

One million new coastal residents could require the conversion of over a quarter of a million acres of forest, wetlands, and farms - **the equivalent of developing five Districts of Columbia along Virginia's coasts over the next twenty years!**

Land development has a direct impact on the health of coastal environments. The removal of vegetation, the grading of the land, the installation and use of septic systems, the increase in impervious surfaces and the use of nutrients and pesticides for lawn care can create substantial nonpoint source pollution. Boat wakes and changes in the shoreline for erosion control or recreational access can harm or destroy aquatic and terrestrial habitat and severely degrade the beneficial functions of both tidal and nontidal wetlands.

Alarmingly, between 1970 and 2000 average house sizes have increased 51% (from 1,500 square feet to 2,265 square feet), average lot sizes have increased by 60%, and average household populations have decreased. (Chesapeake Bay Program, 2004). These changes in land use patterns pose a grave threat to the future health of Virginia's coastal environments.

As a signatory of the Chesapeake Bay 2000 Agreement, Virginia is committed to the goal of reducing the harmful rate of sprawl throughout the Chesapeake Bay watershed by 30% by 2010. Achieving this goal will help protect both the Bay's water quality and Virginia's coasts. Drastic changes will be needed in the way Virginia communities plan and manage land uses if coastal sprawl is to be reigned in.

For more than a decade, Virginia's Chesapeake Bay Preservation Act (the Bay Act) has represented a cooperative program between state and local governments aimed at reducing nonpoint source pollution. The program is designed to improve water quality in the Chesapeake Bay and its tributaries by promoting the application of sound land use planning and management practices on environmentally sensitive lands – referred to as Resource Protection Areas (RPA) and Resource Management Areas (RMA). By implementing the state law through local land use ordinances, the Act allows flexibility to meet local needs, both in terms of existing water quality conditions and unique land characteristics and in terms of the existing regulatory system, yet provides uniform standards for use throughout Tidewater to ensure a basic level of consistency among the various local programs. Despite the success of the Bay Act, the extreme pressure of coastal development demands a broader effort for better coastal land use planning.

Coastal planning exemplifies "Smart Growth" for Virginia's coastal zone[1]. Coastal planning is a land management process for maintaining, protecting, and restoring the natural resources of coastal areas while also enhancing the quality of life in local communities. Successfully planning and managing land use to protect Virginia's coastal resources will require innovative

[1] This description of the inherent need to plan and manage coastal development at three scales of application is drawn directly from Coastal Sprawl: The Effects of Urban Design of Aquatic Ecosystems in the United States. (Prepared for the Pew Oceans Commission by Dana Beach of the South Carolina Coastal Conservation League.) The authors believe Beach did an outstanding job summarizing land planning needs for the protection of coastal environments and attempted to adapt Beach's argument to support the innovative land use approaches being employed by local governments in Virginia that help protect the coastal resources of the Commonwealth.

land use reforms at three scales of application. Regional scale planning determines where land development should occur on a metropolitan scale – which often includes multiple watersheds, hundreds of thousands or millions of acres, and numerous sensitive coastal environments. Neighborhood scale planning determines how development is organized – what street patterns are laid out, and how different land uses are arranged and at what densities. Finally, site scale planning determines how development projects area constructed – what stormwater management, conservation design, and riparian buffer protections will be employed.

Smart Growth Principals

1. Mix land uses.
2. Take advantage of compact building design.
3. Create a range of housing opportunities and choices.
4. Create walkable neighborhoods.
5. Foster distinctive, attractive communities with a strong sense of place.
6. Preserve open space, farmland, natural beauty, and critical environmental areas.
7. Strengthen and direct development towards existing communities.
8. Provide a variety of transportation choices.
9. Make development decisions predictable, fair, and cost effective.
10. Encourage community and stakeholder collaboration in development decisions.

The next two decades will see unprecedented development along the coasts of Virginia. Although substantial energy has been directed toward improving site planning to protect aquatic resources, the continued failing health of many coastal areas indicates that concentrating on site planning alone, in lieu of regional and neighborhood planning, cannot protect aquatic ecosystems from decline. This document provides several examples demonstrating how many of Virginia's coastal communities are already employing a wide variety of land planning and management approaches, at all three planning scales, to help protect Virginia's coastal environments.

Table 1.0: Critical Coastal Features

Submerged Aquatic Vegetation (SAV) provides food and shelter for fish, shellfish, waterfowl, and a variety of invertebrates. SAV absorb nutrients in the water column, buffers wave energy allowing sediments to settle out, and helps oxygenate the water. Like other plants, SAV requires plentiful sunlight. Large amounts of suspended sediments and nutrient-induced algal growth can cause SAV decline by limiting the amount of light that can reach the submerged vegetation.

Oysters provide critical habitat for numerous shellfish, finfish and crabs and help reduce wave energy that can tear up SAV beds and erode shorelines. Oysters can also play a significant role in improving water clarity by removing sediments and organic matter while filtering large quantities of water through their bodies for food. Nonpoint source pollution severely impacts oyster health. Excessive sediments bury and suffocate oysters, heavy metals poison them, and excessive nutrients cause algal blooms that suffocate larval oysters when mass algal die-offs consume much of the available oxygen as they decay.

Riparian forest buffers are vegetated areas adjacent to streams, rivers, marshes and shorelines that form transitional zones between surface waters and the upland. These vegetated areas and the unique soils that these areas create stabilize shorelines and streams banks, filter pollutants from stormwater runoff and shallow groundwater, and provide critical habitat for aquatic species and wildlife. Shoreline development may result in the destruction of the forest vegetation and soils critical to the proper functioning of riparian buffers, eliminating habitat and degrading water quality.

Tidal wetlands including vegetated marshes and swamps and nonvegetated mud and sand flats, are influenced by daily tidal fluctuations Tidal wetlands provide many socio-economic benefits including: water quality improvement, aquatic productivity, fish and wildlife habitat, shoreline erosion control, stormwater treatment, flood protection, potable water supplies, economically valuable resources, and recreation. Shoreland development can degrade tidal wetlands by overwhelming them with excess sediments and nutrients, filling portions for housing and other urban development, introducing invasive plant and animal species, and destroying wetlands through the placement of shoreline erosion structures.

Dunes protect both beaches and inland habitat and property from erosion. By acting as natural barriers, dunes protect inland areas from storms, high waves, and wind. Dunes also hold sand that can replenish eroded beaches. Residential and commercial development is responsible for destroying many dunes in Virginia.

2.0 - Regional Planning for Virginia's Coasts

The long-term protection of sensitive coastal areas can only be achieved by redirecting development pressures from environmentally sensitive coastal environments to those areas of the coast already impacted by development. By concentrating new development in areas previously impacted, the cumulative impact on the health of Virginia's coasts can be minimized while still providing all of the amenities required by modern society.

Dragon Run. Photo credit: Teta Kain

The correlation between increasing impervious surface and decreasing aquatic health is widely recognized in the scientific community. The watersheds of Virginia's coastal zone range from nearly 100% impervious cover to nearly pristine with no impervious cover. Therefore, the central principal of any coastal protection strategy is the identification of those watersheds that are relatively pristine (less than 10% impervious cover) and to attempt to maintain most of them in an undeveloped state. The companion principal is that watersheds with impervious cover of more than 10 percent should absorb the majority of coastal growth over the coming decades[2].

The foundations for effective regional planning and cooperation already exist in many regions of Virginia in the form of Planning District Commissions, Water and Sewer Utility Commissions, and Tributary Strategy teams organized by the Department of Conservation and Recreation for each of the major river basins in the Chesapeake Bay watershed.

Protecting Sensitive Environmental Areas and Significant Open Space

Regionally significant environmental features and significant open space can provide substantial benefits to numerous smaller communities and thus are best managed at a regional scale. The

[2] Beach, 2002. pg. 13

economic and environmental productivity of extensive forests, wetlands, healthy estuaries, and productive agricultural lands can be degraded by peripheral suburban development continually encroaching on these lands or, perhaps worse, development fragmenting these lands. Forest and habitat fragmentation can drastically reduce the natural and economic value of these lands at a rate disproportional to the actual amount of land converted to suburban uses. The Dragon Run Special Area Management Plan is one example of the type of multi-jurisdiction coordination necessary throughout Virginia to protect significant critical areas and open space along Virginia's coasts.

Case Study: Dragon Run Special Area Management Plan
(Adapted from Dragon Run Steering Committee, 2003)

As one of the Chesapeake Bay watershed's most pristine waterways, the spring-fed Dragon Run flows forty miles along and through nontidal and tidal cypress swamps situated in portions of Essex, King and Queen, Middlesex, and Gloucester Counties. The Dragon Run plays a central role in the Middle Peninsula's culture and identity. Natural resource management - forestry and farming - have been the bedrock of the watershed's economy. These land uses, together with extensive swamps and unique natural resources, are the main reasons that the Dragon Run remains wild and secluded.

The Dragon Run's unique character evokes strong feelings in both long-time residents and first-time visitors alike to protect the pristine watershed. Yet, opinions differ about how to address the threats of encroaching development and habitat fragmentation. An innate difference in point of view between property rights advocates and conservationists centers on how to maintain a pristine watershed into the future. Yet, substantial common ground exists for proactively preserving the Dragon Run for future generations that safeguards both natural resources and traditional uses of the land and water, including the property rights of landowners.

The Dragon Run Watershed Special Area Management Plan (SAMP), a partnership between the DEQ Virginia Coastal Program and the Dragon Run Steering Committee of the Middle Peninsula Planning District Commission, is designed to address both the differences of opinion and the common ground that exist concerning the future of the watershed. The Steering Committee believes that the best approach is to bring stakeholders to the table for proactive discussions of the issues. The Steering Committee and its Advisory Group, representing a broad cross-section of the community, have proactively developed a mission, goals, objectives, and action plans to address the priority issues facing the Dragon Run.

The management plan for the Dragon Run watershed represents a body of work by citizens, stakeholders, and local leaders to achieve a common vision for the future – the preservation of traditional uses and the unique resources in the pristine Dragon Run. This is an example of how localities can make a difference by bringing the environmental and business sectors together.

Directing Development Away from Sensitive Coastal Resources

There are several tools available to local, regional, and state government to help encourage development where it will have the least impact on coastal resources. Carefully controlling where and when development occurs can not only protect sensitive environmental areas, but can ensure the most efficient use of municipal infrastructure investment (roads, stormwater, sewer, water, mass transit) – thus helping to minimize the tax burden on local residents.

The timing and location of new development can be directed through local comprehensive plans, zoning and subdivision ordinances, and capital investment plans. These land use tools can designate urban growth boundaries, target development areas, and require the careful coordination of land use and infrastructure investment. Virginia Beach's "Green Line," originally adopted to address infrastructure imbalances in the city's development pattern, has become an effective tool for concentrating new development in already impacted coastal watersheds.

Case Study: Virginia Beach's Green Line
(Adapted from City of Virginia Beach, 2003)

The Virginia Beach Green Line was first established in 1979 to address a significant imbalance between the pace of growth and development and the ability of the city to provide adequate facilities and services to support it. Almost all of the 180,000 people added to the city since its inception reside north of it, much to the benefit of the city's agricultural industry, infrastructure system, neighborhoods and overall quality of life.

Now the Green Line takes its place as one of the critical elements of our redevelopment policy. The city's redevelopment policy and the city's rural preservation policy are not two separate policies. Rather, they are two parts of the same policy. It is the ability to urbanize in select redevelopment areas that allows Virginia Beach to protect its rural areas, and it is the protection of our rural areas that allows the city to urbanize its redevelopment areas. The policies that call for intensification in selected areas of the north will result in greater demand for infrastructure to support it, and so this is where the city will focus a greater percentage of its capital improvement resources. One thing that has not changed, and is not likely to change in the future, is that the city still lacks the fiscal ability to responsibly extend growth-supporting infrastructure south of the Green Line.

Source: The Virginia Beach Shallow Ground-Water Study, USGS Fact Sheet 173-99.

3.0 – Neighborhood Planning for Coastal Communities

Coastal sprawl is "the result of low-density residential and commercial development scattered across large coastal land areas"[3]. By redeveloping and reinvesting in historic downtowns and neighborhoods, redeveloping brownfields and greyfields, and encouraging infill development, existing coastal communities can increase population density and create a vibrant mix of land uses that can help accommodate s substantial portion of Virginia's expected coastal population growth while minimizing the amount of land developed and minimizing related habitat and water quality impacts on Virginia's coasts.

High density, mixed-use communities can also help support a variety of transportation options above and beyond private automobiles. Developing mixed-use communities can help create pedestrian friendly environments that encourage and facilitate walking and biking. High-density development can also be organized across the landscape to form hubs of high-density development that serve as primary mass transit stops.

Case Study: Redeveloping Historic Downtowns – City of Norfolk
(Adapted from APA, 2004)

Norfolk, a once decaying Navy town, has transformed itself into the vibrant, cosmopolitan heart of a metropolitan area of more than 1.7 million people. The City made the leap without help from high tech or high growth by emphasizing planning and by incorporating a huge urban mall to catalyze downtown redevelopment.

Only a few years ago, Norfolk's downtown waterfront was derelict. Granby Street had little to offer except a handful of restaurants, a few low-end clothing shops, and a lot of decaying and empty buildings. Now an estimated 3,000 people live downtown, where once there were only a few dozen. Three major condominium and apartment developments and numerous smaller residential projects are in the works. There is a stage company operating in a historic theater, a club with a capacity of 1,500, an 895-seat performing arts center, and more than 60 restaurants. There is now a community college campus downtown, filling what was once a department store. The crime rate is 40 percent lower than it was 10 years ago, despite an increasing downtown population, and the value of taxable downtown properties in 2004 was 74 percent higher than just seven years earlier.

The Norfolk revitalization model calls for solidifying office space, using entertainment to remove the fear factor, clustering of civic, theater, and museums for a regional draw, growing the restaurant base, and adding housing. The vision is a 24-hour, mixed use downtown. The revitalization of dynamic, interesting downtowns, in which residents can live, work, and play, is absolutely essential in successfully balancing future population growth and the protection and enhancement of Virginia's coasts.

(Beach, 2002, pg iii)

Encouraging Infill Development

Infill development is the reuse of underutilized or vacant land located in existing neighborhoods. Infill development can improve and protect water quality by accommodating growth on sites that have already been developed and may already be impervious, thus eliminating the need for any new impervious cover and the need to disturb new land during construction. When redeveloped at higher densities, infill sites also provided local governments an opportunity to ensure that more people are located in areas with existing infrastructure, housing choices, and transportation choices (EPA WATER, 2004, pg 27).

Since the late 1990s the ***City of Richmond*** has added over six hundred new apartment units by converting old tobacco warehouses in the Shockoe Slip and Shockoe Bottom areas.

Redeveloping Greyfields

The redevelopment of greyfields can help improve water quality while at the same time increasing the value of the land use on the site. Greyfields are abandoned, obsolete, or underutilized properties, such as regional shopping malls and strip retail developments. These sites often have significant redevelopment potential because of their large size, existing infrastructure, and established community presence.

Market Common, a mixed use development in ***Arlington County***, converted the site of a former Sears department store and parking lot into 240,000 square feet of retail space, 300 apartments, 87 town homes, parking garages, and a one acre park.

Redeveloping Brownfields

Brownfields are abandoned, idled or underused industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination. Redeveloping brownfields both removes environmental contaminants from the site and absorbs development pressure that would otherwise be directed to greenfields.

The ***Town of Cape Charles*** included the redevelopment of a 25-acre, former junkyard as the center of a new 200-acre eco-industrial park that includes a 30-acre Coastal Dune Natural Area Preserve and approximately 60 acres of other natural areas.

Maximizing Transportation Choice

Freeing the residents of Virginia's coasts from their dependence on private automobiles is critical to protecting water quality and minimizing the impact on coastal environments. At least 25 percent of excess nitrogen polluting coastal waters is believed to be from atmospheric deposition (Beach, 10). Parking lots, roads, driveways and highways account for the vast majority of the impervious surface that accompanies development. Reducing the number of trips residents drive will reduce the amount and size of future parking lots, roads, and highways. Reducing automobile use will also help reduce the atmospheric deposition of nitrogen and other pollutants that enter the atmosphere from as exhaust from cars and trucks and then settle out on surrounding waterbodies or are washed off impervious surfaces into these waterbodies.

Case Study: Providing Transportation Choice in Arlington County
(Adapted from American Institute of Architects, 2002)

Arlington County's General Land Use Plan focuses growth within a walkable radius of the five metro stations in the Rosslyn-Ballston corridor and preserves established neighborhoods and natural areas. Arlington's urban villages emphasize pedestrian access and safety and incorporate public art, "pocket" parks, wide sidewalks with restaurant seating, bike lanes, street trees, traffic calming structures, and street-level retail.

Metro station locations guide development. Between 1999 and 2002, the corridor, which contains 7.6 percent of the county's land area and generates 33 percent of its property tax revenue, gained 2,500 apartments and condos, 1.5 million square feet of office space, 379,000 square feet of retail space, and five miles of bike lanes.

The transit successes and corresponding environmental performance are impressive. Metro ridership doubled in the corridor between 1991 and 2002; nearly 50 percent of corridor residents use transit to commute. At the end of 2001, the corridor had more than 18 million square feet of office space, 3 million square feet of retail/commercial space, more than 3,000 hotel rooms, and 22,500 residential units—with many more under construction. Creating this development at typical suburban densities could have consumed over 14 square miles of open space compared to the roughly two square mile Rosslyn-Ballston corridor.

4.0 – Better Site Design for Coastal Development

Better site planning is the final key for ensuring that development is carried out in a manner that protects coastal environments. The proximity of coastal development to vulnerable environmental features like oyster reefs, tidal wetlands, dunes and riparian forests, and the nearly immediate and unbuffered impact that development can have on coastal water quality may make effective coastal site planning more critical than site planning elsewhere. In addition, several factors complicate coastal planning.

- **Impervious surfaces** include the total of rooftops, roads, sidewalks, parking lots and any other hard surface and can be used as a measurable indicator to determine the effects of development on aquatic resources because the amount of imperviousness directly affects stormwater runoff and water quality. Numerous scientific studies indicate that water quality diminishes measurably when as little as 10 percent of a watershed is converted to impervious surfaces. As the amount of impervious surface in a region increases, the hydrology of the area is drastically altered, nonpoint source pollution degrades water quality, aquatic habitat is destroyed, and the aesthetic value of natural waterbodies are lost.

Substantial impervious surface along a coastal waterway.

- **Nonpoint source pollution** cannot be clearly linked to an obvious pollution source (a point source) such as an effluent pipe or a smoke stack. These pollutants can include nitrogen and phosphorus, organic carbons, petroleum hydrocarbons, metals such as copper, lead and zinc, pesticides, sediments and in areas without sewer systems, fecal

coliform from septic systems. Stormwater runoff can rapidly transport nonpoint source pollutants across impervious surfaces and directly into coastal waters without allowing for natural pollution removal that occurs when stormwater is filtered through leaf litter and soil mediums.

- The **size of the watershed** and the **types of land uses** draining into coastal embayments, estuaries or other coastal water bodies can buffer or intensify the impacts of coastal development on water quality and aquatic habitat. For example, a small watershed dominated by residential and commercial land uses will have a much more substantial impact on a small embayment than a large watershed dominated by forested lands. Increasing the amount of impervious surface in a watershed can result in substantially more fresh water runoff reaching small embayments, altering the salinity of these ecosystems and making the area less habitable for some species.

- **Tidal flushing** characteristics affect the length of time a pollutant, such as nitrogen, stays in an estuary or embayment. The physical characteristics of an embayment, such as channel depth, the width of the mouth opening and even the direction it faces where it enters a larger estuary can affect the amount of salt water that enters. The shallowness and low volume typical of the less navigable reaches can contribute to longer residence times and, therefore, the likelihood of nutrient over-enrichment. If freshwater inflow and tidal exchange is small, there will be a limited capacity to withstand pollution loads, leading to the degradation of the water and the biological habitat dependent upon it.


Tidal wetlands on the James River

Over the next twenty years there will be a tremendous amount of development along Virginia's coasts. Better coastal site planning will ensure that when and where coastal development

occurs, it will be done in a manner that identifies (through available mapping resources) and plans site development that protects coastal conservation areas, utilizes effective stormwater management techniques to protect water quality, maintains riparian buffers, addresses potential sources of nonpoint source pollution (like septic systems, lawn fertilizer, and pet waste), and minimizes shoreline impacts from excessive shoreline armoring and numerous private water access structures.

4.1 – Conservation Site Design

Conservation site design identifies important conservation areas at the earliest stages of site design. By using all available mapping resources, including those being developed by state agencies like the Virginia Departments of Conservation and Recreation and Forestry (see Table 4.1.1), and carefully assessing significant conservation areas during field visits, site design can better protect coastal resources.

Table 4.1.1: Tools for Mapping Coastal Conservation Areas

Virginia Conservation Lands Needs Assessment **(VCLNA)** is a flexible, widely applicable tool for integrating and coordinating the needs and strategies of different conservation interests, using GIS to model and map land conservation priorities and actions in Virginia. The VCLNA allows the manipulation of issue-specific data sets that can be weighted and overlaid to reflect the needs and concerns of a variety of conservation partners - issues like: unfragmented natural habitats; natural heritage resources; outdoor recreation; prime agricultural lands; cultural and historic resources; sustainable forestry; water quality improvement; and, drinking water protection. Developed by the Department of Conservation and Recreation. For more information see: http://www.dcr.state.va.us/dnh/vclna.htm.

Virginia Forest Resource Information Mapper (ForestRIM) is a web-based interactive mapping tool that allows users to view over 100 maps, including forest resource information, aerial photos and topographic maps. Developed by the Department of Forestry. For more information see: http://www.forestrim.org/.

Blue Infrastructure is an online mapping tool is a web-based interactive mapping tool that provides spatial information for Virginia's aquatic resources. It maps the ecologically and economically significant aquatic resources (marine and freshwater) found within the coastal zone of Virginia, including oyster reefs, blue crab sanctuaries and aquaculture sites were mapped to help coastal land use planners better understand the potential impacts that proposed shoreline development can have on these resources. Developed by the Virginia Institute for Marine Science. For more information see: http://ccrm.vims.edu/blueinfrastructure/bi_intro.html.

Conservation site design (outlined in Table 4.1.2) requires the identification of primary and secondary conservation resources as the first step in site design. By identifying conservation resources as early as possible in the design process, land developers can (1) accurately gage probable environmental regulatory requirements that will be required to develop the land, (2) identify potential "green infrastructure" design efficiencies that should be incorporated into the site design, and (3) more effectively design infrastructure installation based on the placement of principal structures rather than vice-versa.

Table 4.1.2: Conservation Site Design for Coastal Areas
(Modified from Arendt, 1996)

1. ***Identify and map all conservation areas.*** An environmental site assessment identifies and maps coastal features that require permanent protection (primary conservation areas) and those coastal areas that should be protected to the maximum extent practicable (secondary conservation areas).

Primary Conservation Areas

- Resource Protection Areas
- Tidal wetlands
- Tidal shores
- Groundwater recharge areas
- Perennial and intermittent streams
- Non-tidal wetlands
- Riparian buffers
- Animal travel corridors
- SAV beds
- Oyster reefs
- Floodplains

Groundwater aquifer protection

Secondary Conservation Areas

- Resource Management Areas
- Highly permeable soils
- Highly erodible soils
- Farmlands
- Woodlands
- Historic and cultural features
- View shed areas
- Community piers and docks
- Public access to state and federal waters

2. ***Locate building sites outside of conservation areas.*** Once all primary and secondary shoreland conservation areas are identified, the development's structures can be sited. The preservation of primary and secondary conservation areas as permanent open space should not affect the economical viability of a proposed development.

3. ***Design street alignments and walking paths.*** Once the parcel's buildings are sited to ensure the best possible use of the land, streets and walking paths can be designed to efficiently connect all the structures on the site.

4. ***Draw in the lot lines.*** The actual subdivision of the land should be the last step in the site planning process. Subdividing the parcel at the end of the site design process ensures the most efficient use of the land, facilitates the protection of conservation areas, and minimizes complications in the planning and design of necessary infrastructure.

4.2 – Establishing and Maintaining Forested Riparian Buffers

Henrico County - 2-acre riparian buffer installed in April 2003.

Vegetated riparian buffers are one of the most functionally beneficial and biologically diverse systems that also provide services of great economic and social value. Benefits derived from vegetated riparian buffers, especially forested buffers, include water quality protection enhancement, stormwater and floodwater management, stream bank and shoreline stabilization, water temperature modification, wildlife habitat protection, and absorption of airborne pollutants. These benefits can translate into enhanced quality of life and real savings for the community.

Riparian buffers are complex hydrologic and ecological areas that are transitional zones between the surface waters and the upland areas. Although initially thought of as agricultural best management practices, or BMPs, their multifunctional abilities are becoming better appreciated. Traditionally, BMPs were primarily used to control the quantity and quality of stormwater runoff for erosion and sediment, but not necessarily to address issues related to the effects of infiltration and the quality of ground water. A buffer's value lies not only in the ability to moderate erosion and sedimentation, but also in the ability to improve water quality in ground water and surface water runoff, increase the base flow of streams, and provide a biologically diverse habitat.

Buffers may also serve as attractions for tourists and community members, becoming greenways and recreation areas for hikers, birders, photographers, fishermen, picnickers and other outdoor enthusiasts. The influx of visitors to the community can spur an expansion of the local economy from tourism and accessory businesses. These corridors increase the aesthetic appearance of a community, enhance property values, and increase local tax revenues.

4.3 - Effective Stormwater Management

The goal of storm water management is to mitigate the impact on the hydrologic cycle resulting from changes to the land surface. Urban development directly impacts local hydrology by reducing or even eliminating the natural storage capacity of the land. This impact is the result of impervious surface cover replacing tree cover, loose organic surface soils, and natural depressions, all of which provide natural storage capacity. Failure to address increased stormwater runoff can lead to degraded water quality, stream channel erosion, and localized flooding.

Comprehensive stormwater management planning is a necessary part of a holistic approach to watershed management. It identifies areas that should be protected and preserved and stormwater management measures and design criteria to be utilized to protect such areas. In so doing, watershed planning uses and protects ecological processes to lessen the need for structural control methods that require capital costs and maintenance.

As our understanding of the dynamic relationship between development and water resources grows, so should the goals of a watershed plan. A watershed plan should provide:

- guidance as to the areas and resources to avoid and protect,
- development guidelines to minimize the impacts of new development on water resources,
- identification of retrofit opportunities such as BMP retrofits, stream restoration, etc. to mitigate impacts resulting from existing development, and
- appropriate stormwater management options (structural and non-structural) including, when practicable, Low Impact Development, regional stormwater management and urban forestry to compliment and enhance traditional on-site stormwater management.

Low Impact Development

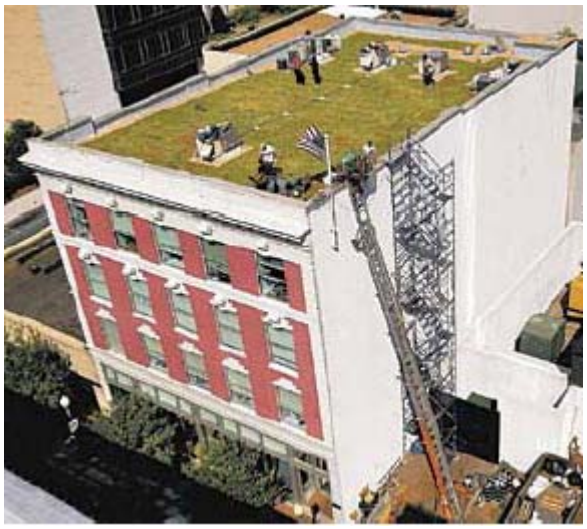
Low Impact Development (LID) is a stormwater management design strategy that maintains or replicates the pre-development hydrologic regime through the use of design techniques to create a functionally equivalent hydrologic site design. Hydrologic functions of storage, infiltration and ground water recharge, as well as the volume and frequency of discharges are maintained

through the use of integrated and distributed micro-scale stormwater retention and detention areas, reduction of impervious surfaces, and the lengthening of flow paths and runoffs time. Other strategies include the preservation/protection of environmentally sensitive site features such as riparian buffers, wetlands, steep slopes, valuable (mature) trees, flood plains, woodlands, and highly permeable soils.

Case Study: Low Impact Development in the City of Norfolk

Green roofs in the City of Norfolk:

Green roofs are an excellent example of low impact development technology that can be used to mitigate both water quality and quantity impacts of development. Like all LID technologies, green roofs attempt to mimic the pre-development hydrology of a site by reducing both the velocity and quantity of stormwater runoff during a storm. Green roofs can also help restore bird/butterfly habitat in urban areas, reduce urban heat island effects, extend the life of the roof, and help reduce heating and cooling costs for the building. Although green roofs are relatively common in some parts of Europe, they are still a relatively new technology in the United States. Several green roofs have recently debuted in Virginia. The Department of Conservation and Recreation and EPA's Chesapeake Bay Program have helped to fund green roofs in Arlington County, the City of Falls Church and the City of Norfolk. (Picture credit: April 2004, Atlantic Building, Norfolk, VA - by Mort Fryman/The Virginian-Pilot.)



Water quality and stream health is maintained through the use of a combination of five design techniques, including conservation, minimization of impacts, maintaining site runoff rate and patterns, the use of integrated management practices, and pollution prevention. Structural, landscape features that employ these design techniques include bio-retention basins or rain gardens and other landscaped areas that encourage infiltration. Infiltration of the water allows the physical, biological and chemical capabilities of the soil to remove pollutants from the runoff. This may be accomplished through absorption, transformation, immobilization, plant uptake or conversion. Any number of landscape features can be used as a rain garden to help remove pollutants.

Regional Stormwater Management Systems

The objective of a regional stormwater management plan is for localities to address the stormwater management concerns in a given watershed with greater economy and efficiency by installing regional stormwater management facilities versus individual, site-specific facilities. The result will be fewer stormwater management facilities to design, build and maintain in the affected watershed. It is also anticipated that regional stormwater management facilities will not only help mitigate the impacts of new development, but may also provide for the remediation of erosion, flooding or water quality problems caused by existing development within the given watershed.

Some localities use pollution credit purchase programs that allow developers to forego installing stormwater management systems that protect water quality on-site. Water quality protection then becomes the responsibility of the local government, which maintains larger regional stormwater best management practices.

Urban Forests

In conjunction with comprehensive, watershed-wide, stormwater management planning, healthy and extensive urban forests can help play a significant role in managing stormwater runoff. Urban trees can intercept, and thus reduce, stormwater runoff reducing the total amount of water reaching structural best management practices. Tree leaves can store a large amount of rainwater that is evaporated into the atmosphere once the storm is over. Tree roots help to create macropores that increase the amount of water urban soils can absorb during storms. Trees also pump a tremendous amount of water from urban soils into the atmosphere through evapo-transpiration. Urban forests can also play a critical role in sequestering carbon (a significant greenhouse gas), mitigating air pollution, reducing the urban heat island effect and providing habitat. Although air pollution, inadequate protection and poor management are overwhelming many urban forests, they continue to provide substantial benefits to many communities, as demonstrated in Table 4.3.

TABLE 4.3: ESTIMATED VALUE OF URBAN FORESTS [4]					
Locality	**Total tree canopy (acres)**	**Air pollution removal***	**Tons of carbon stored**	**Total stormwater management savings**	**Estimated annual benefits of urban forest**
City of Hampton	4,559 (12.1%)	467,338 lbs $1,184,154	195,958 tons	$172,603,455 $15,048,356 per year**	$16,232,510
City of Norfolk	1,183 (2.9%)	121,319 lbs $307,400	50,870 tons	$177,305,691 $15,458,318 per year**	$15,765,718
City of Richmond	8,691 (21.7%)	875,403 lbs $2,037,288	373,559 tons	$226,780,945 $19,771,796 per year**	$21,809,084

* Includes: Carbon Monoxide, Ozone, Nitrogen Dioxide, Particulate Matter, Sulfur Dioxide
** Annual costs based on payments over 20 years at 6% interest

4.4 - URBAN NUTRIENT MANAGEMENT

Many everyday uses can contribute nonpoint source pollutants, like nitrogen and phosphorous, to local waterways. Minimizing nitrogen polluting septic systems and educating landowners about appropriate lawn care and pet waste management can help protect coastal water quality.

Septic Systems

When properly functioning, conventional septic systems reduce pathogens and some nutrients by filtering effluent through the soil medium of the drainage field. However, studies show that even properly installed and maintained conventional septic systems remove less than 30% of the nitrogen from effluent. Unfortunately, septic systems are much more complicated and require more maintenance than many homeowners realize. Improperly functioning and failing septic systems exacerbate the problem of subsurface water contamination that results from the fact that conventional septic systems are not designed to efficiently and effectively eliminate nitrogen from effluent. Depending on the physical, chemical and biological characteristics of the soil, a large portion of nitrogen from septic systems may reach ground and/or surface waters, substantially contributing to the total nutrient load.

[4] These estimates were developed using American Forests' Citygreen software and summarized in a "Rapid Ecosystem Analysis for 2001" for each city. Analysises for many other communities throughout the Chesapeake Bay watershed are available at www.americanforests.org/campaigns/ecological_services/.

The most effective means of managing septic system pollution is to require new development to connect to municipal sewer. Centralizing the management of wastewater treatment at municipal facilities allows for more regular maintenance and upgrading of necessary infrastructure by highly trained, professional staffs rather than thousands of individual landowners. As a last resort local governments should require that all new and replacement septic systems in coastal areas incorporate denitrifying technology.

Septic tank pump-out.

Lawn Care

Lawn care products applied to residential lawns and golf courses also provide a significant amount of nutrients to groundwater and surface waters. Rather than depending entirely upon buffers to remove nutrients, homeowners can take a pro-active approach, by reducing the size of their lawns and minimizing nutrient application. Sound lawn care techniques, such as those advocated by the Alliance for the Chesapeake Bay's *Bayscapes* program are necessary components to nutrient control. Limiting fertilizer to only that necessary for proper lawn care, in the proper season, using Integrated Pest Management (IPM) techniques to minimize the use of pesticides and minimize herbicide use are measures that require the participation of individual homeowners, and residential lawn care specialists. Homeowner associations and managers of public parks and golf courses and other open spaces should also be included in educational efforts.

Pet Care

Homeowner education should include pet waste management. A large dog can contribute as much waste as a small child; however, pet waste often enters waterways untreated. In the same way that septic effluent contributes an excess of nitrogen and bacteria to groundwater, pet waste can contribute to contamination of surface and groundwater. The consistent removal and

appropriate disposal of pet waste from lawns is one more tool in the reduction of over-enrichment of adjacent waters.

4.5 - MINIMIZING SHORELINE DISTURBANCES

The installation of shoreline hardening and shoreline access structures often requires grading or the removal of shoreline or upland vegetation and marsh leading to direct and indirect habitat losses on the project site and adjacent properties.

Shoreline Erosion Control Structures

Both natural and structural control techniques may be used to reduce shoreline erosion. Careful selection and design of the control technique is important to prevent accelerating erosion rates elsewhere. Structural erosion control methods can increase erosion immediately downdrift, if improperly sited or designed. Therefore, it is best to reduce, to the extent possible, the need for structures through appropriate site planning. If erosion control is required, selecting the best-suited strategy for the particular problem and location requires a careful assessment of the existing conditions.

Rip-rapped shoreline vs. natural shoreline

Should the anticipated wave energy at the shoreline and the tidal range indicate a need for a structural solution to a shoreline erosion problem, site-specific design criteria should be applied to arrive at the appropriate control method. Sound technical advice should be sought to decide which control method would cause the least amount of harm to adjacent aquatic and riparian features. The least obtrusive erosion control technique should be implemented with special

consideration given to maintaining shoreline habitat. Table 4.5 provides a brief overview of preferred shoreline stabilization options based on the local erosion rate.

Table 4.5: Minimizing Shoreline Disturbance (CBLAD, 2003)

Note: Alternative #1 is the preferred control method with subsequent methods being listed in descending order of preference.

Areas with Low Erosion Rate (< 1 ft/yr.)
(low energy shorelines with an average fetch exposure of <1 nautical mile)

1. Vegetative stabilization with/or bank regrading
2. Revetment
3. Bulkhead

Areas with Moderate Erosion Rate (1- 3 ft/yr.)
(medium energy shorelines with an average fetch exposure of 1-5 nautical miles)

1. Vegetative stabilization with/or bank grading
2. Beach nourishment / breakwaters
3. Revetment
4. Groins
5. Bulkheads

Areas with Severe Erosion Rate (> 3 ft/yr.)
(high energy shorelines with an average fetch exposure of > 5 nautical miles)

1. Relocation (of threatened structures)
2. Beach Nourishment / breakwaters
3. Revetments
4. Groins
5. Seawall

Community vs. Private Piers and Docks

The cumulative impacts of the construction and operation of private piers and docks can result in substantial degradation of the shoreline and near shore waters. The shade created by docks may affect SAV beds and habitat quality for juvenile fish. Docks, piers or other public boat access facilities may also contribute toxic chemicals directly to the water. Even small amounts of chemicals from wood preservatives can have toxic effects on shallow habitat organisms.

Community facilities should be considered in order to reduce the cumulative impacts of numerous private docks and piers. Community facilities concentrate the disturbance and

pollutant loads in a manner that may be more easily and economically managed and mitigated. Appropriate densities for piers and docks should be based on a number of factors including aesthetics, public access, flushing characteristics of the waterbody and sensitivity of nearby aquatic habitat.

Additional access to the shoreline by boats and other recreational vehicles causes another set of challenges to the shoreline's health. Hard surfaces are usually required to facilitate vehicular access to boat ramps. The process of creating access damages woody buffers and destroys oyster and submerged aquatic vegetation beds. Motorized boating activities in narrow shallow embayments can potentially harm both terrestrial and aquatic resources from increased wave forces and increased turbidity. This activity causes physical damage to submerged aquatic vegetation beds and the shoreline.

Community boat dock.

5.0 – Implementing Better Coastal Planning

The various techniques that can help achieve better coastal land use planning must be incorporated into each community's land use planning documents. Some of the most significant planning documents will include the Chesapeake Bay Preservation Area ordinances comprehensive plans, zoning and subdivision ordinances, watershed management plans, and natural hazard mitigation plans.

Chesapeake Bay Preservation Act Ordinances

The Chesapeake Bay Preservation Act (§ 10.1-2100, et. seq.) and the Chesapeake Bay Preservation Area Designation and Management Regulations (§ 9 VAC 10-20-10, et. seq.) is one of the most effective tools used by local governments to manage land development along the vast majority of Virginia's coast line.

The Act, enacted in 1988, established a cooperative program between state and local government aimed at reducing non-point source pollution. The program created to implement the Act is designed to improve water quality in the Chesapeake Bay and its tributaries by requiring wise resource management practices in the use and development of environmentally sensitive land features. At the heart of the Act is the idea that land can be used and developed in ways that minimize impact on water quality.

The program requires Tidewater localities to prepare inventories of environmentally-sensitive land features, to designate Chesapeake Bay Preservation Areas based upon the findings of that data collection and analyses, and then to amend their local land use management systems, including zoning and subdivision ordinances and comprehensive plans, in order to protect water quality (§ 10.1-2109 of the act). Specifically, local governments must adopt and implement performance criteria to apply within Chesapeake Bay Preservation Areas. The Board, in developing local program requirements, has utilized a resource-based approach that recognizes the differences between various land forms and treats them differently, according to the unique characteristics which they possess. Land use and development are regulated where necessary and in a degree appropriate to the type of land form on which they are located. The Act allows

flexibility to meet local needs, both in terms of existing water quality conditions and unique land characteristics and in terms of the existing regulatory system, yet provides uniform standards for use throughout Tidewater to ensure a basic level of consistency among the various local programs.

The Act and Regulations should directly support other water quality planning programs and activities in coastal Virginia. For localities under the Act, the threshold for the statewide erosion and sediment control requirement compliance is reduced from 10,000 square feet of land disturbance to 2,500 square feet, thus capturing many more land disturbing activities. Water quality requirements, including stormwater management, are mandatory in the 84 Tidewater localities, whereas the State's voluntary stormwater management enabling legislation focuses upon control of quantity and is permissive. In addition to non-tidal wetland permit requirements, wetlands connected by surface flow to perennial water bodies and non-tidal wetlands are protected as Resource Protection Area (RPA) features; and, other wetlands may be included by a locality as a protected RPA feature.

Comprehensive Plans

The Comprehensive Plan should establish land use designations based on knowledge of land development suitability and potential impacts to sensitive aquatic living resources. Emphasis should be placed on future land use and development policies since the greatest potential to protect water quality is in the undeveloped large tracts of land that can benefit most from advanced planning. Comprehensive plans can designate areas for special consideration and set policy on jurisdiction-wide or watershed-wide issues that have the potential for broader impacts, such as stormwater management, wastewater management or boating access. Local comprehensive plans could include the following to protect coastal environments:

- Develop policy to protect ***high risk*** sensitive resource locations.
    1. Create Preservation Areas for especially sensitive resource locations.
        - Purchase of land for greenways trails, parks or conservation areas
        - Purchase or transfer of development rights from current land owners
        - Purchase of Conservation Easements

2. Designate Overlay Districts that require development requirements beyond the current regulatory standards to protect the sensitivity of the shoreland and natural resources.

- ❖ Develop policies to limit private and public access points using risk-based analyses of affected embayments.
- ❖ Develop policies to establish appropriate embayment-wide shoreline management methods for each embayment based on the particular conditions found there prior to development pressure.
- ❖ Develop and adopt a comprehensive wastewater management program with site-specific wastewater treatment standards based on a combination of site suitability and location in a variety of sensitive resource protection areas.
    - o Implement with inspection and enforcement procedures.
- ❖ Address all of the coastal elements included in the Chesapeake Bay Preservation Area Designation and Management Regulations, including:
    - o Physical constraints to development (e.g., soil suitability for septic systems);
    - o Protection of potable water, including groundwater resources;
    - o Land use impacts on fisheries and other aquatic resources;
    - o Siting of docks and piers;
    - o Water quality impact of public and private access to waterfront areas;
    - o Mitigation of water quality impacts due to pollution from land uses;
    - o Shoreline and streambank erosion problems;
    - o Potential water quality improvement through redevelopment.

Zoning and Subdivision Ordinances

Traditional zoning tools can be used to limit development in vulnerable coastal environments. Local governments can set minimum standards, but allow flexibility through performance standards that may allow alternative development techniques that still meet the performance goal. An example would be changing a requirement of one-acre lot size minimums to a requirement of no more that one home per acre. Such a standard could allow for smaller lots while leaving a substantial amount of open space and hopefully reducing impervious surfaces as well. Improved design standards could also be incorporated into subdivision ordinances

allowing more flexibility in design to those who wish to develop in more sensitive areas but are willing to incorporate conservation performance standards into their subdivision. Local zoning and subdivision ordinances could include the following to protect coastal environments:

- Revise Environmental and Stormwater Management standards to encourage the use of Low Impact Development where the physiography is suited to such methods.
- Allow flexibility in subdivision development standards for implementing the principles of Better Site Design.
- Establish special zoning districts adjacent to high and moderate risk coastal areas.
    1. Create Districts that require stricter development standards for higher risk coastal areas, such as:
        - Require alternative nitrogen reducing on-site wastewater treatment systems.
        - Limit the number of access sites in an embayment.
        - Minimize land disturbance and grading.
        - Limit location/amount of shoreline hardening.
        - Require regional marinas.

    2. Require Planned Unit Developments to negotiate stricter development standards for higher risk coastal areas.
- Limit the impervious surface allowed per site, or per developed subdivision.
- Develop a Landscape Ordinance that limits clearing to the house site and requires a percent canopy coverage per lot.
- Encourage Conservation Subdivisions in higher risk coastal areas.
- Where feasible, develop lot size limits to minimize impacts to high and moderate risk coastal areas.

Watershed Management Plans

Watershed management plans identify the specific actions necessary to restore habitat and water quality, identify lands for conservation and development, reduce nonpoint source pollution, and prioritize pollution reduction actions. Watershed management planning establishes partnerships between local and state governments, and community organizations with the common goal of

protecting the watershed. This coordination helps encourage a more holistic approach to implementing or modifying many existing programs like the comprehensive plan and zoning and subdivision ordinances. Coordinating community efforts to create a watershed-focused plan can help communities meet their watershed goals more quickly and efficiently.

Natural Hazard Mitigation Plans

Natural hazard mitigation planning helps state and local governments identify the potential impacts of likely natural hazards and necessary actions and activities to reduce the potential losses from those hazards. Developing a hazard mitigation plan helps communities recognize that human and economic losses due to natural hazards stem not from unexpected events, but from the predictable outcomes of interactions between (1) the physical environment, (2) the social and demographic characteristics of coastal communities, and (3) the built environment. Luckily for coastal communities, many of the coastal features that are critical to water quality protection and plant and animal habitat (e.g., tidal wetlands, dunes, riparian forest, etc.) can also mitigate the impacts of many coastal natural hazards like hurricanes, storm surges, and flooding.

6.0 – Conclusion

The coasts of Virginia will become home to roughly one million new residents over the next twenty years. If these new residents are accommodated through conventional land development patterns, similar to those in the 1990s, hundreds of thousands of acres of Virginia's coast will be converted from forests, wetlands, and farmlands to homes, malls, highways and parking lots. The development of this stupendous amount of coastal area will cause irreparable harm to coastal water quality, air quality, animal habitat and green infrastructure, will burden local governments with tremendous infrastructure costs, and will expose many thousands more properties and individuals to coastal hazards.

However, by encouraging smart growth at the regional, neighborhood and site planning scales, Virginia can balance both future population growth and environmental protection and improvement. By directing development to previously impacted coastal areas and reinvesting in existing communities, developing high-density, mixed-use communities, and maximizing

transportation options, local governments can facilitate growth and development and help protect Virginia's precious coasts. Careful site planning will help create interesting, safe, pedestrian-friendly places to live, work, shop and play while minimizing the impacts of stormwater runoff and protecting Virginia's valuable coastal resources.

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